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EDITORIAL.

Dissemination of Research Results among Agricultural Producers.

A department of agriculture cannot consider that its sole function consists in research work, but most accept the responsibility of evolving the organisation to be entrusted with the work of dealing with the practical application of such results and of passing them on in a palatable form to the producers.

The methods for the achievement of this practical application of research have varied in different countries. In the past it has been difficult for organisers to obtain very exact knowledge of the operation of schemes in other countries, so that each department has had to devise a system without the very helpful knowledge of the practice adopted in other countries.

The Empire Marketing Board has conferred a very real service on agriculture by the publication of a Report under the title "The Dissemination of Research Results amongst Agricultural Producers." This publication is a compilation of answers to a questionnaire circulated by the Board to all Empire Governments in 1927.

Sir Daniel Hall, in an introduction to the volume, traces the steps that appear to be most generally applicable in rendering science of use to primary producers. He states that the discoverer has fulfilled his purpose if he has arrived at a principle; he is rarely interested in the details whereby it can be translated into practice, for which he may not have facilities. The results should reach the staff of instructors and means should be devised of keeping them in touch with developments of their subject. For this purpose he stresses the value of annual meetings of organisers, instructors and advisers, when the investigators can expound both their own and parallel work.

The recent agricultural conference in Kuala Lumpur is an instance of such organisation which has been found most helpful, not only to the instructors—in this case the field staff of the Department—but to the research staff.

Another aspect of the subject is discussed by Sir Daniel Hall—that of general information concerning improved farming which the ordinary cultivator or stock-keeper requires. Such producers fail because they do not utilise common knowledge—scientific or practical. He states that with "the bulk of farmers in any country, the problem is how to bring home to them not so much

the results of recent research but the common facts upon which their calling is based—practical, scientific and economic. This is the task of the educational service, and if the educational service is effective very little need be done to ensure that it will pass on all the practicable results of recent research."

It is suggested that there are three classes of producers. Firstly, the plantation industries growing a single crop on a large scale. "The managers of these industries require highly specialised information proceeding from investigation. They are receptive of such information and are generally ready to adopt it. From the point of view both of investigation and of the dissemination of information they can best be served when the individuals will associate and assist in the maintenance and direction of a special experiment station devoted to their industry only, however closely this station may be associated with or administered by the Department of Agriculture."

For meeting the needs of the second class—the great mass of primary producers—generally farmers cultivating more than one crop—Sir Daniel remarks that their need is not so much technical knowledge as character, energy and developed intelligence and it follows therefore that the factor determining their quality as farmers will be their general education as human beings. But putting aside the organised instruction of young persons by formal methods there is agreement that effective work among adults comes with personal contacts. For this purpose, personal visits to holdings, visits of farmers to demonstration and experimental farms and plots and meetings for discussion are especially advocated. Lectures, broadcasting, films, bulletins and journals all suffer from the disability of less intimate personal contract. Any educational effort in which the students are led to play a part, in which they are active participators, leads to more permanent results than other forms of instruction. As a means to this end, exhibition trains and motor vans are mentioned.

Thirdly is instanced the very large and important class of non-European cultivators in tropical countries. For this class demonstration is particularly effective.

From the foregoing summary of the opinions of an eminent student of agriculture we must leave the reader to estimate to what degree the extensional services of the Department of Agriculture, the Rubber Research Institute and the Co-operative Department satisfy the needs of Malaya. We have problems peculiar to ourselves and for these we must devise our own solutions, but in many respects the problems of Malaya are but a replica of those in other colonies, and we can therefore gain much knowledge of the subject by study of the publication referred to above.

Control of Rats. Some idea of the seriousness of the rat menace in Malaya may be gathered from the fact that as a result of the Rat Campaign in the Krian District of Perak, 1,791,790 rats were destroyed in 1930. The area covered by this work is the 50,000 acres of the Krian Irrigation Scheme. In the neighbouring territory of Province Wellesley, 1,514,928 rats were

accounted for in 1930. The area covered by this campaign is rather less compact than that in Krian.

One would naturally anticipate rat trouble in padi-growing districts, but in the present instance there are two rather arresting facts in connection with these results. Firstly, the number of rats accounted for is less than the total number killed, for poison is extensively employed in the campaigns; and secondly—and more important—the campaign in Krian is no spasmodic endeavour of the Government to restrict rat damage, for the work has continued incessantly in the District for the past six years, during which period over 5,500,000 rats have been destroyed—an average of over 20 rats per acre per annum. It needs no flight of imagination to visualise the destruction of padi which would have been occasioned in the absence of such control measures. The average cost has worked out at about 2 cents per rat, so that the results have been commensurate with the cost. It is estimated that the annual saving of padi by reason of the rat campaigns in Krian and Province Wellesley alone is sufficient to feed 12,000 people each year.

The necessary for rigorous rat control is not confined to padi-growing districts. Oil palm and coconut estates, for instance, experience considerable damage by these rodents.

Mr. F. W. South contributes an article in this number on "Rat Destruction in Malaya" which enumerates the methods which have proved efficacious in the Government campaigns in this country and embodies the experience gained by planters who have found it necessary to inaugurate schemes covering the areas under their control.

We would emphasise two points that emerge from these campaigns; rat control necessitates continued effort and can only be really successful where a variety of methods of destruction are employed.

Original Articles.

RAT DESTRUCTION IN MALAYA

BY

F. W. South,

Chief Agricultural Field Officer.

During the year 1924 Sir George Maxwell, then Chief Secretary to Government, suggested that a special campaign for the destruction of rats in padi fields might yield useful results. Consequently, work was commenced in a definite portion of the irrigrated padi area in Krian on the 15th. November, 1924. This campaign had three objectives in view. It was intended to destroy as many rats as possible before the padi harvest; it was also intended to arouse among local padi growers a greater and more practical interest in rat destruction; and finally, it was expected to provide information regarding the best methods of rat control.*

This campaign proved so successful that it was extended in 1925 to include the whole of the padi area in Krian, while in 1927 a similar campaign was commenced in Province Wellesley and in October, 1929 in Malacca.

Use has been made of the experience gained to arouse an interest in rat destruction among Malay padi growers in all parts of the Peninsula. Information on rat destruction has been conveyed to the public by means of pamphlets in Malay and in English and by special exhibits staged at Agricultural Shows.

Moreover, control of rats has proved to be of considerable importance on oil palm estates, since these animals eat the buds of recently planted young palms, gnaw through the leaf stalks of palms about two years old and eat the ripe fruit on mature palms. Rats are also a serious pest in clearings of young coconuts, where they eat the buds as they do in the case of young oil palms, and in clearings on rubber estates recently planted with germinated seed, seed at stake, young seedlings or baskets plants. Numerous requests have been received during the last two years for advice on the control of rats and the experience gained in the padi fields has been of value in enabling recommendations to be made for similar work on estates.

In the present article some recent information on methods of destruction is given together with a short review of the results obtained both on estates and in padi fields. The information has either been kindly supplied by estate managers or taken from reports submitted by the Agricultural Field Officers and the three Rat Destruction Officers stationed in Krian, Province Wellesley and Malacca respectively.

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* Malayan Agricultural Journal, Vol. XIII, pp. 168 and 364.

Methods of Destruction.

Three methods of rat destruction have been used; namely, trapping, poisoning and hunting. Poisoning has consisted mainly in the use of poisoned baits, but the injection into rat burrows of calcium cyanide dust, yielding a poisonous gas, has also been tried. The term "hunting" is here used to include both organised rat hunts and the digging out of nests of young rats during the main breeding season.

Trapping.

The persistent and methodical use of traps has proved to be one of the most satisfactory methods of destroying rats. Fuch's Steel Rat Traps, of the guillotine type, have been found convenient and economical for this purpose. The various types of traps made locally by Malays, mostly on the dead-fall principle, are also effective.

Baits for traps must be carefully chosen. If one kind does not prove attractive another must be tried. If trapping has to be maintained continuously, it is desirable to change the baits fairly frequently. On estates, rubber seeds, pieces of coconut—either alone or dipped in coconut oil—and padi grains have proved successful. In padi fields, padi grains are most commonly used, but dried prawn is also satisfactory. Small pieces of tapioca root or of sweet potato are also likely to be attractive. Baits should always be clean and fresh and should be handled as little as possible. Traps in which rats have been killed should be cleaned before further use. Some years ago, during an outbreak of rats on coconut estates, it was believed that traps dipped in coconut oil before being placed in position caught more rats than undipped traps.

Rats are intelligent and cautious animals to which the scent of their natural enemy, man, is often stated to be repellant. For this reason it is customary to recommend that the handling of bait should, so far as possible, be avoided and that, when setting traps, precautions should be taken to avoid or mask the human scent. Such precautions are rubbing the hands in earth before handling the traps, or dripping the traps, after setting, in coconut oil. In a recent article Schander and Gotze * express the opinion that the human scent does not much affect rats and state in support of this view that bread carried for a time in human armpits was readily eaten by rats. On the other hand, these authors admit that rats very quickly associate its particular smell with anything harmful to them. Consequently, the possibility remains that, in a community in which a number of rats are being killed by traps carrying the human scent, the survivors will learn to associate the scent with danger to themselves. The same argument applies to the smell of coconut oil or of any bait used. Hence the necessity for

* Zentralblatt fur Bacteriologie, Parasitenkunda und Infektions-krankheiten, Band 81, Sept. 1930, p. 342.

frequent changes of bait and of avoiding the too continuous dipping of traps in coconut oil.

In order to set an effective number of traps in each acre simultaneously throughout the whole of a large estate, a very large number of traps would be required and an appreciable number of labourers would have to be employed. For continuous work this would involve considerable expense. Consequently, it has been suggested that the estate be divided into a number of convenient areas and that traps be set in a few of these on one night and in an equal number on the next night, the areas being so arranged that traps are set in each once in seven to ten days and that the areas worked on any one night are at a considerable distance from those in which traps were set on the previous night. On oil palm estates it is suggested that the number of traps should be about one to each palm.

In padi fields, traps are placed at intervals on the bunds. Whether in padi fields or on estates they should be placed near rat runs, rat holes, suitable cover for rats or damaged plants.

Poisoning.

The poisons which are generally used are commercial sodium arsenite or barium carbonate. Experiments have also been conducted with the proprietary poison Zelio Paste.

(a) *Sodium arsenite.* Various baits have been tried with this poison, but that which has proved most consistently satisfactory in the padi fields of Krian and Province Wellesley is made up on the following formula :—

Sodium arsenite	...	...	...	1 part by volume
Rice polishings	...	...	...	4 parts „ „
Dried fish or prawn	...	...	...	1 part „ „

Enough coconut or palm oil is added to bind the mixture into a stiff paste. A little water can also be added if necessary.

The ingredients are thoroughly mixed and then rolled into small balls.

When a large number of such balls are needed they can conveniently and cheaply be prepared by the following method, which has been worked out by the Agricultural Field Officer Selangor, Mr. Doscas. The ingredients in the proportions given above are thoroughly mixed in an earthenware water jar, the smaller size of " Shanghai jar " is suitable, and the paste is then passed through an ordinary culinary mincing machine, using the medium cutter. As the material is delivered from the machine it is sprinkled with rice polishings and rolled into balls by passing the hand over the mass once or twice with a circular motion. The balls are then placed in a gunny bag well sprinkled with rice polishings and rotated quickly up and down; finally the balls are laid on sacking to dry and set for about twelve hours, after which they can safely be transported in cases. The balls are preserved by the arsenic and will keep indefinitely.

The hands of all the coolies engaged in preparing the baits should be well smeared with oil of aniseed before commencing work; by this means the human

smell is masked and the baits are given an aroma which is attractive to rats. The scent rapidly disappears, but can be renewed by introducing a few drops of aniseed oil into the case before use.

Arsenic is a very dangerous poison and should not be used in situations where it is easily accessible to children or domestic animals. For the same reason, coolies who have been handling the poison or poisoned baits should be made to wash their hands and arms very thoroughly as soon as they stop work. The stock of poison should be kept in a strong, locked receptacle.

The balls are easily dissolved by rain and for this reason should be put down in sheltered positions during wet weather, or inside short lengths of bamboo. The latter method has the added advantage of rendering the baits almost inaccessible to most domestic animals.

Another very effective form of bait is a grasshopper or dragonfly. To prepare the bait the insect is caught and killed. Its body is slit open and filled with a small quantity of poison. The insects thus prepared are placed in as natural a position as possible on clear parts of the bunds of padi fields or in convenient places near the individual growing plants on estates. Rats seem unable to resist these insects and will take them continuously, apparently not becoming suspicious of them as they do of artificial baits.

Other baits mentioned as used on one estate are rice, padi or rice bran boiled and mixed with poison at the rate of 6 gantangs (gallons) of the bait to 6 cigarette tins of sodium arsenite; on another estate, tapioca, sweet potato, rubber seeds, a mixture of bran and crushed prawn ('blachang') and also of bran and coconut fried with groundnut oil have been used as baits. No definite results from the use of these different forms of bait are recorded.

(b) *Barium carbonate.* This poison is less dangerous to human beings than is sodium arsenite. For use in poison balls, prepared in the same way as with sodium arsenite, the mixture is made on the following formula:—

Barium carbonate	...	...	...	...	2 parts by volume
Rice polishings	...	...	...	...	4 parts „ „
Dried fish or prawn	...	...	...	...	1 part „ „

Coconut oil or palm oil are added, with water if required.

Barium carbonate can also be used in baits of grasshoppers and dragonflies as already described. On one oil palm estate the fruit bunches are lightly sprinkled with this poison, a method which has proved very effective, numbers of dead rats being found on the area regularly so treated.

Poison balls made with barium carbonate have to be used promptly, as this salt has not the preserving action of arsenic and the balls soon become mouldy and develop an unpleasant smell.

Barium carbonate causes the poisoned rats to become thirsty and to search for water, so that dead rats are most commonly found in or near water.

(c) *Zelio paste* is a proprietary preparation containing thallium sulphate. The quantity required to kill a rat is about 0.2 gram. When not fatal, the poison is stated to affect the reproductive organs, rendering them sterile.

Zelio paste, spread on small pieces of bread, has been tried in buildings in Europe. In April 1930 it was tried in the Bagan Serai rice mill with Chinese sweet cake as bait. The poison was spread on two slices of cake which were then made into a sandwich and cut into small pieces about ½ to ¾ inch square. Of 104 baits put down 53 were taken in the course of one week, but no dead rats were found although these animals were reported to be plentiful in the mill.

In Province Wellesley the paste has been made up into poison balls with the same mixture of rice polishings, dried fish and coconut oil as is employed with sodium arsenite. Of 494 baits put down in May in shops, houses and mills all were taken within twenty-four hours and 240 dead rats were found. In rice fields the results were not so good, though comparable with those obtained with sodium arsenite. Of 345 baits put down during April, 193 were taken in two days and 45 dead rats were found, while elsewhere of 200 baits 79 were taken in one day and 37 dead rats were found. In the same neighbourhood, but somewhat later in the month, 450 baits made with sodium arsenite were put down. Of these 145 were taken in 24 hours and 76 dead rats were found. The number of dead rats found is not a reliable indication of the effectiveness of the baits, since the rats often die in a thick cover of grass, weeds or bush and are not found. It will, however, be seen that of the baits made with Zelio paste approximately the same percentage were taken as of those made with sodium arsenite.

In July 300 balls made with Zelio paste were put down. In a maximum period of three days 155 were taken and 12 dead rats were found. In this trial it was believed that the quantity of poison in the baits was insufficient, the available supply at the time being rather limited.

In October a further trial was carried out in Province Wellesley, the baits being made up on the following formula: Zelio paste 5½ oz., Rice Polishings 72 oz., Coconut Oil 10 oz., Dried Fish 8 oz., a few drops of oil of aniseed were added. This mixture gave 833 baits. The results obtained are shown in the following table:—

Locality.	*Date.*	*No. placed.*	*Date examined.*	*No. taken.*	*Dead rats found.*
Northern District	6-10-30	300	7th & 9th	63	6
Central District	do.	333	do.	75	9
Southern District	do.	200	do.	154	79
		833		292	94

The presence of much water in the padi fields of the Northern and Central District interfered to some extent with the trial.

In December another experiment was carried out in Province Wellesley.

The formula used for mixing the baits on this occasion was :—Zelio Paste 6 ozs., Rice Polishings 55 ozs., Coconut Oil 7½ ozs., Dried Fish 6 ozs. A few drops of aniseed oil were added. This mixture gave 663 balls which were put down on December 26th. in a patch of tall, thick sedge. On the 28th. 74 dead rats were found and it was estimated that 546 baits had been taken.

In preparing these baits, the coconut and aniseed oils and Zelio paste were thoroughly mixed together in a mortar. The rice polishings and dried fish were mixed in a basin and the oil and paste mixture was then slowly added, the whole being thoroughly mixed until the required consistency was obtained.

The results recorded with Zelio paste have been promising. Further trials are contemplated and the cost of the poison is being compared with that of sodium arsenite.

Use of Aniseed Oil. As it appeared doubtful whether the addition of oil of aniseed to baits rendered them more attractive to rats, a series of experiments was carried out in Province Wellesley to decide this point.

The poisoned balls used were made by mixing 22 ozs. of sodium arsenite, 72 ozs. of rice polishings, 10 ozs. of coconut oil and 8 ozs. of dried fish. This unit mixture was used to make 600 balls. To one unit a few drops of oil of aniseed were added. A second unit was made without this oil. The balls were put down in small groups at regular intervals, a group with oil of aniseed alternating with a group not containing the oil. The number of balls in each group was the same.

Of 1,200 balls not containing the oil 429 were taken in one or two days, 96 dead rats being found. Of the 1,200 balls containing oil of aniseed 752 were taken in the same period and 185 dead rats were found. Thus the baits made with oil of aniseed were considerably more attractive than those without it. In these experiments, as in those with Zelio paste, the number of dead rats found is not a reliable measure of the success of the baits. More importance attaches to the number of baits taken. These results are in opposition to those recorded by Schander and Gotze. In their article already referred to the authors state that their feeding experiments gave no proof of any preference on the part of rats for aniseed oil. They also drew attention to the danger that rats would learn to associate harm to themselves with any strong smell from aromatic substances used in the preparation of baits and emphasised the need for frequent changes of baits and aromatic substance.

Rat Virus. It has been claimed that certain species of bacteria cause deadly and very infectious diseases among rats. Carefully prepared cultures of these bacteria are sold as different kinds of rat virus, such for example as Liverpool Virus, Danysz Virus and the Virus, *Bacillus typhi murium*, prepared by the Pasteur Institute in Paris. It is, further, often claimed that the diseases caused by the bacteria in these various types of virus are harmless to man and to domestic animals.

Unfortunately, the virulence of any particular virus is liable to wide variation, even among different samples prepared in the same way, and in consequence their

action is unreliable. Moreover, by no means all rats which eat baits impregnated with virus are killed and those that survive become immune and may possibly give rise to partly immune offspring. It has also been found that the diseases caused by the different types of bacteria are often not readily contagious, so that, even with a virulent strain of virus, only the individual rat which eats the impregnated bait is killed; the effect being then the same as that of a chemical poison.

Another objection is that some strains of these bacteria may not be so harmless to man and to domestic animals as they were at first thought to be.

The most important objection, however, to the use of any form of rat virus in Malaya is the harmful effect upon it of comparatively high temperatures. This would necessitate the use of cool storage both during the transport of the virus from Europe and during its storage in this country.

Moreover, for successful use a virus must be comparatively freshly prepared. Consequently, either fresh supplies would have to be imported at short intervals, or a supply would have to be maintained locally. Since much work is involved in maintaining a supply of virus of a high degree of virulence, it is more than doubtful whether the uncertain results obtainable would justify the cost of producing a local supply.

In view of the objections mentioned above and of the satisfactory results obtained by other methods, the use of any form of virus in this country is not at present recommended.

Effectiveness of Poisons. The chemical poisons described above are by no means rapid in their action and may require 24 hours or more to cause death. For this reason poisoned rats are able to move to some distance and hide in burrows or thick cover, so that a number of those killed are not found.

The comparative absence of dead rats often leads to a belief that the poison used is ineffective. The tables given above, however, show that this is not the case and this view is supported by other evidence in the possession of this Department. Very recently a Malay Headman produced figures to show that of over 12,000 dead rats recorded in a padi area in Selangor only about 2,000 had been caught in traps, while the remainder were found dead during a period when poisoned baits were in regular use in these particular padi fields. Experience is convincing the Malay padi growers of the value of poisoned baits for which there is now a big demand in most parts of the country.

It must, however, be remembered that rats soon learn to recognise poisoned baits, especially if they are left about as they have to be when used on a large scale under field conditions. In wet weather most of those left uneaten probably dissolve and are washed away in a few days, but in dry weather they remain for some time and tend to increase the suspicion of the rats. Consequently, a new kind of bait should always be tried whenever it is fairly obvious that the bait in use is not proving successful.

Calcium Cyanide Dust. Reference was made to the use of this substance in an article on page 168 of Vol. XIII of this Journal. Although the dust proved

effective, little further use has been made of it. It is so dangerous a poison, owing to the evolution of hydrocyanic acid gas, that its use has to be restricted to carefully trained labourers.

In some parts of the country rat burrows are common in the bunds of padi fields during the drier weather, and the injection of this dust into them certainly kills a large number of rats. The work, however, requires close supervision and trained labour involving considerable expense. Moreover, where a reward is offered for each rat tail, Malays and Tamils prefer to dig out the rats with their young so that they are able to claim the reward.

Hunting.

The use of this method in padi fields was described in Vol. XIII, p. 168 of this Journal. It has not become widely popular among Malays as yet, though it is gradually being adopted in areas where rewards are offered. Its use is mostly confined to the period when the padi fields are being cleared of weeds or to the time of harvest. Thus, organised drives were common throughout Province Wellesley in July 1930 when the land was being cleared for planting. In such cases an area of about 1 acre of weeds was cut from the outside inwards, the rats sheltering in the centre. Cutting was continued until only about ¼ acre of weeds remained and was then stopped until the children returned from school. The boys, armed with sticks and other handy weapons, then surrounded the patch and killed all the rats that ran out as their elders completed the cutting.

Certain oil palm estates rely mainly on hunting for the control of rats. The labourers are encouraged, by the offer of rewards of 1 or 2 cents a tail, to turn out in the evenings with their dogs and hunt rats. In this way between 2,500 and 3,200 rats are destroyed each month on one estate.

Another form of hunting consists of digging out rats and their nests from the bunds of padi fields. This method was extensively employed by Tamils in Province Wellesley during the dry weather following the padi harvest in 1930. In the Province, as probably in other parts of the country, the rats appear to breed most prolifically in the two or three months just after the padi harvest when the supply of food is plentiful, that is in March, April and May. During these months the rats accounted for in the Province were respectively 76,489, 116,522 and 137,345, of which the greater majority were very young animals brought in by professional Tamil rat-catchers, though some were collected by Malay school children under the leadership of their teachers.

General Observations.

Experience shows that in localities such as padi fields and oil palm estates, where rat control has to be maintained continuously, reliance should be placed on intensive trapping and poisoning, aided by hunting when practicable. All such efforts must be sustained. Spasmodic efforts are useless and only result in a

waste of money. On oil palm estates work must be continuous throughout the year; in some padi growing areas, however, it is possible that rat destruction could be discontinued without any ill effects during the two or three months immediately preceding the time when the land is cleared for planting. This point will receive investigation.

Rat control on oil palm estates is assisted by the removal of any forms of cover such as jungle stumps and logs. Thick growths of close-growing cover crops afford cover for rats, provide in their seed a plentiful supply of food and handicap all methods of rat destruction. Consequently, it has been suggested that cover crops should not be grown on flat land planted with oil palms, since their disadvantages are liable to outweigh their advantages.

Removing Cover in and around Padi Fields. In the areas where definite rat compaigns are being conducted, it has been found that the damage done to the standing padi crop by rats is confined to the neighbourhood of places which afford protection or cover for these animals. Consequently, such damage can be materially reduced by cutting down all patches of high growing grasses or bushes in the immediate neighbourhood of the padi fields and by taking such action as is possible to ensure that all the padi land is cultivated, since any portions left unplanted are usually covered with a dense growth of weeds in which rats can harbour, often in considerable numbers. While the cutting of heavy growths of weeds in and around padi fields is not in itself necessarily sufficient to prevent rat damage to the standing crop, yet experience shows that it is a useful adjunct to the methods already described for the destruction of the rats.

Results.

Both in Krian and in Province Wellesley a special staff consisting of a European Rat Destruction Officer and a few Malay Assistants has been employed to direct and supervise the rat campaign. Poison balls have been distributed, usually free of cost, and rat traps have been sold at cost price. Rewards of one cent a tail were paid for all tails collected until the 31st. of October 1930, since when the reward has been reduced to ½ cent a tail. The numbers of tails for which rewards have been paid are shown in the following summary:—

	Krian.		*Province Wellesley.*
1st. November 1924 –			
31st. December 1925	661,794		.....
1926	673,102		.....
1927	842, 791	Sept. 1st. to Dec. 31st.	100,000 (over)
1928	914,644		509,151
1929	623,712		579,972
1930	1,791,790		1,514,928

In addition, a number of rats have been killed by poison and have not been found. It is roughly estimated that rat damage has been reduced from about 6 per cent. to about 1 per cent. of the standing crop in these two important padi growing areas. Since the average total crop for both is 25,000,000 gantangs (gallons) of padi a year this saving represents 1,250,000 gantangs of padi a year.*

In Malacca the campaign has been in operation throughout 1930. At first the Malays were unwilling to bring in rat tails and claim the reward of 1 cent each, but later collections were made through the schools while Chinese also become interested, with the result that rewards were paid for 75,817 rats during the year. Much attention was given to the removal of suitable cover from the surroundings of padi fields and, on the whole, the work has resulted in a satisfactory diminution in the damage done to the standing crop.

In other parts of the country rewards are not paid and no special staff is provided. The District Officers and the Agricultural Field Officers co-operate to make traps and poison available at cost price; pamphlets are distributed and Malay officers constantly give advice on all the measures recommended for reducing damage to padi by rats. Such action has roused considerable interest among Malay padi growers, notably in the Negri Sembilan and Pahang in which States much useful work has been done during 1930.

Estates have made use of different methods or combinations of methods of rat control. An indication of the results obtained is given in the following summary of information supplied by managers of estates.

On a clearing of 600 acres planted with germinated rubber seed 150 traps were set daily. The only bait which the rats would take was rubber seeds. The average catch for the first few days was 45 rats a day. This gradually decreased to an average of 25 a day. The decrease in damage to the young rubber plants was marked.

Another rubber clearing of 300 acres was planted with seedling and basket plants early in August 1930. To protect these, rat control measures were commenced in the previous June. Poisons and traps were used. Up to the end of November 657 rats had been trapped. Only two poisoned rats were found, but, as up to the date given not a single plant had been damaged, it seemed probable that the poison was more effective than the number of dead rats would indicate. At the end of the year the rubber trees were becoming too old to be subject to damage by rats. On this estate a poisoned bait was placed beside each hole before planting and a second supply of baits was put out after planting.

Two oil palm estates rely on hunting for rat control, the labourers being encouraged to hunt by the payment of rewards. This measure has met with a fair degree of success. On one of these estates grass and a cover crop are grown, but the Manager states that although they give a certain protection to the rats he does not think they have a serious effect on control measures. On the other estate one division is also under a mixture of grass and cover crops and

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*A gantang of padi weighs about 6 lbs.

the Manager states that on this division hunting has proved less successful. Poison has also been used, but the results obtained are uncertain, since the rats make for water after taking the poison and are not seen again.

Finally one estate makes use of different combinations of control measures according to the age of the oil palms to be protected.

One area consists of six year old palms in bearing. The area is under grass but is widely circle-weeded. The bunches of fruit are lightly sprinkled with barium carbonate which has proved very effective, numbers of dead rats being found. Every evening coolies hunt through this area for a reward of 2 cents a tail, obtaining on an average 50 tails a day. This system is effective since, though a proportion of the fruit is eaten by rats, serious damage and loss of fruit is prevented.

In another section of three year old palms commencing to fruit, the fruit bunches are sprinkled with barium carbonate and poisoned baits are set near any trees damaged by rats. This method is also reported to be successful.

In another section of two year old palms trapping and poisoning are systematically employed with success, no serious damage having so far been caused to the palms.

In both these sections there is a cover of Centrosema and the Manager expresses the opinion that this not only harbours rats, but offers them food and excellent breeding grounds from which they cannot be removed.

Finally, on an area of 1 year old palms no cover crop has been planted and the area has been kept clean weeded. Rats are stated to be unknown and most of the palms are unguarded. Up to the present not one palm has been touched by rats.

Two other planters state definitely that serious rat damage previously experienced ceased after the cover crops present had been removed and a third attributes freedom from rat damage to the absence of a cover crop. The Principal Agricultural Officer, Johore, endorses these views by stating that in his experience successful rat control measures are practically impossible in areas where heavy cover crops have been established and that the removal of such cover crops is the first step to take when rats have become a serious pest.

In conclusion, it may again be emphasised that only organised and persistant control measures will afford satisfactory protection against rat damage to such crops as padi and oil palms, while any relaxation of control is liable to result in a rapid increase in the number of rats and the consequent waste of much of the money previously spent.

POLLINATION OF OIL PALMS UNDER FIELD CONDITIONS

BY

J. N. Milsum and J. L. Greig,

Assistant Agriculturists.

Introductory.

In previous issues of the *Malayan Agricultural Journal* (vide Vols. XIV, page 384; XVI, page 20; XVII, page 16) papers were published recording the results obtained by pollinating artificially a number of oil palms under avenue conditions. The experiment conducted over a period of three years, showed conclusively, that under conditions obtaining a considerable increase of crop resulted from artificial pollination, while the growth of the two sets of palms showed no material difference. Subsequent records for the years 1928 and 1929 respectively show similar results.

It must be admitted, however, that this experiment is open to criticism, since the palms are not growing under normal estate conditions and further, no attempt was made to examine the crop records from a statistical standpoint.

Description.

The experiment under consideration comprises an area of approximately 20 acres of oil palms (*Elacis guineensis*) growing on undulating land at the Government Plantation, Serdang. The soil may be described as quartzite clay loam with occasional intrusions of underlying laterite, typical of the inland soils of Selangor. The land is undulating, and silt-pitted throughout at the rate of one silt-pit per palm.

The palms are planted 30 ft. by 30 ft. triangular, i.e. 55 palms per acre. Pollinated palms and control palms are in alternate rows throughout the entire area under experiment. The total number of rows is 68, of which 34 alternate rows are under treatment and the remaining 34 rows serve as a control.

The palms were planted in May, 1922, and commenced to bear fruit during the latter part of 1925. Artificial pollination commenced in January, 1926 and has been carried out continuously since that date. The results published in the present paper are those obtained during a period of over four years, namely from October 1926, until December 1930.

Method of Pollination.

The palms receiving artificial pollination were patrolled every alternate day and a maximum of one female inflorescence per palm pollinated every five weeks, i.e. approximately ten pollinations per palm per annum. Fruit bunches were

harvested as they became ripe from both sets of palms and recorded monthly as total number of bunches and their weight. Owing to the large number of bunches handled it was not found practicable to record the actual weights of cleaned fruit harvested. It may be safely taken, however, that the percentage of fruit to bunch in the pollinated bunches is greater than in the case of unpollinated bunches. The weights of bunches were, in every case, taken in the field to prevent confusion. The inflorescences receiving artificial pollination were marked and dated on the leaf base in the axil of which the inflorescence arose, in order to determine whether the following inflorescence came within the pollination cycle or not.

Yields.

In the following tables the yearly number and weights of bunches are recorded. Table I represents a summary over the entire period. Under the heading of pollinated palms, the crop records are divided under two sub-headings, namely, pollinated bunches and unpollinated bunches, the latter being those bunches which have been pollinated by natural agencies. The percentage increases of crops harvested from the pollinated palms over that from the control palms for the period 1926-1930, are shown in Table II. Table III gives a comparison of the annual average weight per bunch for pollinated and unpollinated bunches. The column on the right shows the percentage increase, per bunch, of the artificially pollinated bunches over the controls.

A statistical examination of the results was undertaken in order to determine whether the conditions obtaining in both control and pollinated palms, other than artificial pollination, were the same. The method employed is that described by Fisher, (vide "*Statisitical Method for Research Workers*" by R. A. Fisher, 1925, page 109 et seq.); to test whether two samples belong to the same population or differ significantly in their means.

Taking the monthly yields as observations when t was calculated for the period October 1926—June 1930 there was a significant difference between the means of the pollinated and controls. t was also calculated for the average weight of naturally pollinated bunches from both control and pollinated palms. There was no significant difference between the means which showed that the average bunch produced by both sets of palms when naturally pollinated were the same.

t was ascertained in the same way for the period October 1926—December 1930 with slightly different results. Taking the monthly yields there was a significant difference as before.

When t was calculated for the average weight of naturally pollinated bunches a significant difference between the means was found. The mean average weight taken over monthly readings of the control palms was significantly greater than the mean average weight from the pollinated palms. The apparent explanation is that the naturally pollinated bunches are not maturing to such a large size on the pollinated palms, since the palm is maturing 103.9 per cent. more fruit than

TABLE 1.

Summary of Yields 1926-1930.

Year.	Pollinated Palms.						Control Palms.		Remarks.
	Pollinated Bunches.		Unpollinated Bunches.		Total of previous two columns.				
	Number	Weight lbs.	Number.	Weight lbs.	Number.	Weight lbs.	Number.	Weight lbs.	
1926	311	4,383	506	3,596	817	7,979	607	3,371	October—December.
1927	1,552	27,398	1,618	9,836	3,170	37,234	2,809	18,061	
1928	1,862	50,462	1,729	13,408	3,591	63,870	3,214	28,912	
1929	1,983	60,301	2,204	31,344	4,187	91,645	3,345	49,806	
1930	2,287	78,882	2,466	33,895	4,753	112,777	3,386	53,578	
Total	7,995	221,426	8,523	92,079	16,518	313,505	13,361	153,729	

TABLE 2.

Percentage Increases. Period 1926-1930.

Year.	Pollinated Palms. Total weight of bunches.	Control Palms. Total weight of bunches.	Percentage Increase Pollinated Palms and Control Palms.
	lbs.	lbs.	
1926	7,979	3,371	136.6 per cent.
1927	37,234	18,061	106.1 ,,
1928	63,870	28,912	120.9 ,,
1929	91,645	49,806	84.0 ,,
1930	112,777	53,579	110.5 ,,
Total ...	313,505	153,729	103.9 ,,

TABLE 3.

Average Weight per Bunch per Annum for Pollinated and Control Bunches.

Year	Pollinated lbs	Control lbs.	Percentage increase.
1926	14.09	5.55	153.87 per cent.
1927	17.65	6.43	174.49 „
1928	27.10	9.00	201.1 „
1929	30.41	14.89	104.23 „
1930	34.49	15.82	118.02 „
Average for whole period	27.70	11.51	140.66 „

the control palms by weight and 70.6 per cent. of this crop is produced on artificially pollinated bunches weighing 140 per cent. more.

Summary.

1. A field pollination experiment with 20 acres of young oil palms, conducted during a period of 4¼ years is described.

2. The percentage increase of crop due to artificial pollination is shown to be 103.9 per cent. for the period. Further, the bunches pollinated artificially show an increase in average weight over the bunches from the control palms of 140.66 per cent. for the whole period.

3. The results have been examined statistically and show no material difference in average weight of naturally pollinated bunches from the two sets of palms. On the other hand, there is a marked significant difference between the weight of bunches harvested from the artificially pollinated and control palms. Hence, it may be deduced that the crop increase is due solely to artificial pollination.

FACTORS OF QUALITY IN COPRA

BY

F. C. Cooke,

Assistant Chemist for Copra Investigations.

Well prepared copra is white, of low moisture content and brittle, the pieces of copra being of good size and without " smalls." The meat is of good thickness and has a high oil content. If these conditions are satisfied, the copra will arrive in Europe insect and mould free, white and sweet.

Colour.

Besides yielding a colourless oil, white copra also yields a light coloured cattle cake. Caramelised, superficially burnt, or black copra yields an oil of varying redness which may in some cases be only partially bleachable and a cattle cake which the farmer will reject on appearance and perhaps also because of the smell of associated distillation products from the drying fires. It is also suspected, but not yet confirmed, that insects are especially attracted by slightly burnt copra, particularly where cell rupture has occurred.

Moisture.

Wet copra is the standard product bought by the local dealers in native copra because at certain seasons of the year —notably in November and December —it is impossible to sun-dry copra satisfactorily in this country. During the day the air is about 79 per cent. saturated with moisture while at night the relative humidity averages 95 per cent. Apart also from seasonal fluctuations, humid days and relatively dry days alternate irregularly so that it is impossible to work on standardised lines in order to obtain a standard product either by sun-drying alone or by kiln-assisted sun-drying. Careless preparation, therefore, becomes the rule and local dealers adjust their prices accordingly.

In Table I, certain records are given relating to the atmospheric conditions existing in an important coconut district and from these figures an approximate estimate may be made that in the most humid month it takes four times as long to sun-dry copra as during the driest month, while on certain days it will be quite impossible to effect any drying. Thus in the month of November, a piece of wet copra (moisture about 50 per cent.) was exposed in the sun for five days by which time it still contained 35 per cent. of water and was heavily covered by a multi-coloured mycelium of copra moulds.

To make matters still worse, there is the added factor of heavy moisture generation when such badly prepared native copra is stored under unsatisfactory conditions (see later).

TABLE I.*

Atmospheric Conditions on the Selangor Coast (Bukit Jeram).

1929 Mean Hourly Values For Relative Humidity (Day).

Hours :—	9	10	11	12	1	2	3	4	5	6
July ...	78	74	71	68	68	67	67	69	70	74
November ...	86	81	75	74	74	75	76	79	83	88

Mean Values.

	Day (10 hours)	*Night (14 hours)*	*24 hours.*
July	71	88	81
November	79	95	89

	Hours of strong sunshine. (daily mean).	*Strong windy days.*
July ...	... 8.5 hours ...	... 1 day
November ...	... 6.4 hours ...	... 3 days

Relative Drying Power of air (Shade).

Assume no drying at about 80 per cent. humidity.

	Day	*Night*
July ...	... 96 units	0
November ...	... 27 units	0 (? with moisture reabsorption).

At this stage the related question of moisture reabsorption might be considered. While it is claimed for the Philippines (1) that 5 per cent. moisture represents approximately the stable moisture content in copra there, the Malayan figure depends on the time of the year and, of course, on the structure of the copra. A skinned over or "case-hardened" copra will naturally take up moisture more slowly than a uniformly dried piece of copra (see later).

It has been found that during the dry season, copra can be dried to 4 per cent. moisture content and will remain dry and that wetter copra will on very

*Extracted from the records of the Meteorological Branch, Survey Department, S.S. & F.M.S.

(1) Philippine Journal of Science, March 1917. Brill Parker & Yates.

prolonged storage under good conditions continue to dry out to this figure. In the wet season, similarly well-dried copra will, however, reabsorb moisture slowly to between 6 per cent. and 7 per cent. for "case-hardened" copra and even up to about 10 per cent. for copra which has not a protective skin. About 6 per cent. represents the average stable condition for kilndried copra stored in bulk. It would materially assist the welfare of the industry and simplify the handling and marketing of this commodity if this figure were adopted as the standard by all producers.

During transport to Europe, all the copra produced in this country dries further and almost invariably on arrival at its destination the moisture content is between 4 per cent. and 5 per cent.

To allow for moisture loss and possible deterioration of quality in transit, the usual practice is for the shipper to claim a weight allowance of about 5 per cent. whether such a loss occurs or not.

Copra Deterioration.

A copra of satisfactory moisture content, (viz. 6 per cent.), is liable only to the formation of a thin white mould which readily falls off in transit leaving the copra clean and white on arrival in Europe. Copra of higher moisture content produces white, brown, green or heavy black moulds apparently indiscriminately with the development of heat, free acidity, rancid odour and internal darkening of the material. Black mould in particular is indicative of copra with a moisture content in excess of 10 per cent. The factors which determine the development of specific moulds are in course of determination as it is fairly certain that the moisture content is more an agent than a controlling factor.

It is specially interesting to note that the process of decomposition adds moisture to the copra so that when bad copra is stored in ill-ventilated store rooms or transported in leaky boats, the quality may easily become progressively worse and result in a hot, slimey, dark, evil-smelling, matted product of high acidity but with a high oil content (see Table 3 and later).

Two samples of copra were stored for two months in sealed tins with the following results :—

Description.	*Original Moisture per cent.*	*Final Moisture per cent.*	*Description.*
White, crisp ...	4.5	5.4	F.M.S. quality maintained.
White ...	12.1	64.7	Rank smell. Black, congealed and rotten.

While such slimey copra is of no value for export purposes, it is sold locally at a cheap price and commands a ready sale to certain Malayan oil mills. It is

important to explain why such copra contains a high percentage of oil while at the same time heavy losses are incurred during the process of deterioration, both oil and copra being converted to water vapour and gas and lost.

Oil Gradient.

When slices are cut from pieces of cocount meat parallel to the testa or brown skin and the different slices are analysed it is found that an oil gradient exists in the meat which in the case of ungerminated nuts is particularly marked. The figures in Table 2 serve to illustrate this point.

TABLE 2.

Oil Gradient in Coconut Meat.

Nut Selected.	Oil Percentage (dry basis). Slices of equal thickness.					
	1	2	3	4	5	Testa.
Ripe brown nut ...	40.0	64.6	67.2	75.8	73.7	13.8
Ripe (1″ haustorium) ...	52.0	68.2	72.8	76.0	76.4	...
Overripe (4″ haustorium).	...	73.8	70.2	74.5	74.5	...

TABLE 3.

Copra Deterioration. To illustrate the relation between high free fatty acid (f.f.a.) and high oil percentage.

		Good undeteriorated copra.	Insect ridden copra.	Mould and insect ridden.
Malayan Estate Copra	No. of samples ...	16	2	8
	Average oil percentage.	65.8	65.4	66.8
	Average f.f.a. percentage	.1	.2	.8
Straits Native Copra	No. of samples ...	6	7	19
	Average oil percentage.	64.8	65.2	67.0
	Average f.f.a. percentage	.3	1.2	1.6

Thus, when moulds attack the inside face of a piece of copra, it would appear that as the tissue containing the lowest oil percentage is broken down and removed in the form of gas and water vapour the unattacked copra that remains becomes progressively richer in oil. As deterioration progresses (in the absence of insect attack) the average oil percentage therefore increases and figures in excess of 70 per cent. oil for low grade Malayan copra are quite common. Only in very exceptional cases is the percentage of oil lower than 66 per cent. in mouldy Malayan copra, i.e. when copra is uniformly rotten throughout.

During such deterioration free acidity, and the further destruction products of glycerol render the copra sour and evil-smelling and the resulting oil and cattle cake dark and unpalatable.

However, it is important to note that the ether extract includes the free fatty acid so that deteriorated copra does not contain as much neutral oil as analytical results expressed as oil percentage (dry basis) may appear to show. The importance of this observation lies in the fact that the purification of an extracted coconut oil to remove its free acidity yields in large quantities what is known as "dirty soap stock" and in an edible oil factory the disposal of this bye-product is difficult while in the soap factory it can only be used in low grade soaps, because it retains most of the dirt and colour of the oil. This soap stock is not of much value and its removal by caustic soda is expensive.

During deterioration by heat, moulds, or insects, there is a concealed loss of oil and copra constantly proceeding which may be very considerable. It is the producer who suffers from these causes, because the various buyers allow in the price they are able to offer for anticipated depreciation in transit.

That actual loss of oil and copra occurs during deterioration has been shown experimentally in Fiji (2) by exposing copra on a drying "Vata" to the action of air borne moulds. In 14 days it was found that the copra dried to 5 per cent. but that it lost 12.4 per cent. of its anhydrous weight and 8.2 per cent. of its total oil while the free acidity rose from .2 per cent. to 8.5 per cent.

It has been found in Malaya that if bad copra, which has developed a high degree of rancidity, is stored under good conditions of free ventilation, the acidity diminishes while the copra as a whole will become dry and clean and the mould will fall away as dust. Six large samples were stored for three months under excellent conditions and the results are given in Table 4.

It would appear that the drying of the copra arrests further acid formation from the neutral oil while the existing fatty acids are converted into water vapour and gas and removed with a consequent reduction in the f.f.a. content.

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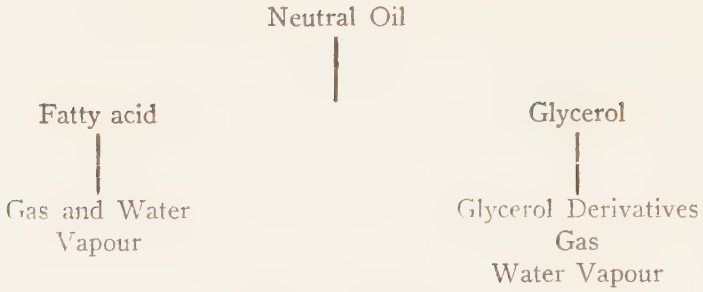
(2) Blackie, Agricultural Journal, Fiji, Vol. 3, 1930, page 78.

TABLE 4.

Effects of Storing Native Copra.

Date of Receipt 28-12-29.

Original Appearance.			Acidity of oil per cent. (as lauric acid.)			Final Appearance.
			30-12-29	28-2-30	18-3-30	
Light brown ...	Mouldy	Superficial insect attack ...	.72	.42	.42	All the copra now dry and mould free but exceedingly insect ridden—originally the samples looked different, now they look similar.
Light brown ...	Mouldy	Superficial insect attack ...	1.72	.43	.22	
Dark brown ...	Very mouldy	Insect-ridden ...	2.48	1.82	1.51	
Dark brown ...	Very mouldy	Insect-ridden ...	3.02	1.21		
Dark brown ...	Very mouldy	Insect-ridden ...	3.12	1.76	0.80	
Dark brown ...	Very mouldy	Insect-ridden ...	3.43	2.15	2.04	
	Average		2.42	1.30	1.12	



Physical Properties.

Apart from its good keeping qualities, well-dried brittle copra is to be preferred because as has been stated by an authority in England, rubbery copra does not press well. When the pressure is applied the oil flows satisfactorily, but at the end of the operation when the pressure is released, the cake tends to suck up the oil again owing to the elasticity of the material. This authority has stated that with such copra it is not possible to reduce the oil below 7 per cent. whereas good friable copra yields a cake with 5 per cent. oil.

Such rubbery copra may be produced from young nuts, and "case hardened" copra with a wet core will also show elastic properties. It is interesting to note that "case-hardened" copra appears to show considerable resistance to mould attack except in the presence of insects which are able to pierce the burnt crust and so expose the wet copra beneath to mould attack.

Size.

If the pieces of copra are too large, the consignment will naturally be very bulky, and the best practice is to chop the half nuts into four pieces. The manufacturers object to copra of large size on the grounds that it takes longer to charge the machinery and more storage room is required owing to the bulkiness of the material.

At this point some reference might be made to the advantages of the baling of chopped copra. To date, one firm in this country has exported during the past year 500 tons of "F.M.S." copra in baled form to Europe with entirely satisfactory results. An article on this subject giving the experimental results obtained has already been published and further experimental work is proceeding to explore the possibilities of the baling of the lowest grade of copra available on the Singapore market.

It should be noted (a) that copra can be compressed at a pressure of 1.5 cwts. per square inch without loss of oil either during compression or subsequent strong and shipment. (b) That the "broken stowage" is reduced, e.g. 20 cwts. of baled copra occupies only the same cargo space as 12 cwts. of sacked copra. Local transport and shipping freight charges can accordingly be reduced. (c) The bales stack squarely leaving straight channels for air movement through the

stack. (d) The bales, which are 2 cwts. in weight, can be easily checked and are of convenient size and shape. (e) There is no evidence that "F.M.S." copra deteriorates more in transit in baled form than in sacks, nor is there any loss of oil.

If the material is much broken up so that there are "smalls" the dealer objects because :—

(a) this allows the careless or deliberate inclusion of foreign matter, (grave exception is taken to sand, nails, etc. which can do great damage to machinery.)

(b) it makes sorting of "mixed" copra into "F.M." and "F.M.S." grades difficult.

(c) much broken up copra exposes a large surface to mould and insect attack and the smallest pieces are gradually converted to a grey fibrous dust which gives the material a dirty appearance. The small pieces are also readily lost in handling.

(d) the cattle cake derived from such copra will be sour and darker than the best.

The production of "smalls" should, therefore, be avoided and it is recommended that, where the meat must be extracted wet from the shell in the field, as far as possible only fully-ripe nuts should be harvested. The meat of unripe nuts is very adherent to the shell, while the thin meat of very over-ripe nuts is inclined to break. On the other hand, where the halved nuts are transported to the kiln and are subjected to semi-drying, the half pieces of meat readily fall out of the shell. When the fully dried copra is subsequently chopped to reduce the bulk, care must be taken to obtain pieces of even size. It is doubtful, however, if this practice is to be recommended as a fresh wet surface is thereby exposed to mould attack. It would be better to chop the copra when half dry as it comes from the shell and then dry and seal the cut surfaces.

Thickness.

As far as possible, only fully ripe brown nuts should be used for the production of copra because such nuts produce the greatest thickness of dry meat. The practice of picking unripe nuts in order to take advantage of a favourable market, or to obtain a speedier cash return, or because crop collection is leased out, or to anticipate theft, is well known.

Oil Content.

It has been shewn that bad copra can contain a high percentage oil content i.e. high ether extract. At the same time the yield of neutral oil will be small and it will be of low quality on account of extraction difficulties. A large amount of soap stock has to be removed to purify the oil, while much of the original colour and odour is still retained in the oil even after refining.

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* Cooke, Malayan Agricultural Journal, June, 1930.

The ultimate objective is to produce a copra equivalent in physical condition, appearance and oil content to the "F.M.S." Ceylon product. In Ceylon a white copra of high oil content is regularly produced, and receives special preference in the London market. The related questions of cultivation and soil improverishment are being investigated, while correct nut harvesting and possible oil loss during copra preparation are also being studied with a view to correcting the alleged decline in the oil content of good quality Malayan copra during the last ten years.

Abstracts.

THE FOURTH WORLD'S POULTRY CONGRESS.

The Congress was held at the Crystal Palace, London, from July 22nd. to 30th., 1930, and was attended by over sixty delegates. Mr. T. D. Marsh, Assistant Agriculturist, represented the Federated Malay States. In conjunction with the congress was held an international exhibition of poultry, pigeons and rabbits. Upwards of 7,000 head of poultry were on view from all parts of the world. The British exhibits were the most numerous, although 1,500 birds were sent from the American continent.

Mr. Marsh has prepared a report on the Congress with numerous interesting comments and the following points are drawn from this report.

Dealing with the Exhibition, he points out that the event provided an unique opportunity for breeders to acquire fresh unrelated stock as practically all exhibits were for sale.

It is of interest to note that the exhibition was essentially one of utility poultry. The utility type is being selected to differ from what is known as the true exhibition type. The exhibition bird has had its value in the past and will no doubt also have in the future in providing a fixed type of foundation stock for the production by selection of pure-bred utility poultry. At the present time, the exhibition stock is being exploited for the production of either pure-bred or cross-bred types or sex-linked birds.

The appliances exhibited in the trade section were very comprehensive. Amongst the exhibits were mammoth incubators, in which each separate machine will hold 16,000 eggs, which are heated and ventilated by machinery.

Battery brooders of many designs, but all comprising a series of superimposed trays up to about six, and capable of holding hundreds of chicks, from the time they are hatched until they are several weeks old, were shown. These machines disregard successfully all previous methods of rearing poultry, which included exercise, sunshine and the open air; the success of the system is due mainly to correct feeding with a supply of sufficient minerals and vitamins.

Poultry houses of many different patterns and sizes were shown, which provide for correct ventilation and lighting. A recent innovation is "slatted" floors in which batons, square or rectangular in section, about $\frac{5}{8}$ inch wide are used with a space between of about $1\frac{1}{4}$ inch; a wooden floor about six inches below the slatted floor is built to catch "droppings". These houses are always clean, as the manure can easily be raked out at one side of the house.

Machines that caused interest were egg-graders and a plucking machine, British made, which, although it will not pluck the birds completely, should be a great saver of labour in large establishments.

A very large number of papers were presented at the Congress sessions and it is impossible to do justice to them in these brief notes. In relation to Breeding and Incubation, there were 29 papers. The other groups of papers were :—

Nutrition and Rearing; Diseases and their control; Economics, including Marketing; Education and General; and Rabbits.

Much valuable information was given in the 25 papers concerning nutrition and rearing, some of which might be applied to conditions in Malaya and in the tropics. It is probable that mixed poultry food could be imported from England which would be more economical to feed and less likely to carry parasites and disease than those purchased locally; that is, for an established poultry farm where large quantities were required.

The series of thirty-two papers on diseases and their control should provide a valuable indication to the nature of the disease known to the Malays as "Bulan Tujoh Sakit," which is very contagious and destroys thousands of fowls annually. It is possible that the Malayan disease is one of the known diseases of poultry; a comparison of the symptoms with those described in the papers would possibly identify the disease and if not, the remedial measures and preventatives would suggest methods that would reduce the annual mortality of Malayan fowls.

Research work on fowl diseases is being conducted at the Veterinary Institute, Buitenzorg, Java, by Dr. W. K. Picard. The results of his work on "Pseudo fowl pest" may show on examination that the symptoms of this disease are similar to those of Malayan fowls.

Amongst the educational papers one which should be of interest to Malaya is that given by the poultry expert to the Government of the United Provinces of India on poultry feeding in the tropics. It states results achieved by a trial and error method which is not very scientific, but which gives some experience gained in India with European and Indian stock.

It will be seen that the Congress papers cover a very wide field of research and are deserving of close attention.

TRANSPORT OF MANGOES AND POMELOES BY SEA.

Reference has been made in previous numbers of this Journal to various aspects concerning the transport of fresh fruit by sea.* The recent publication in Dutch of two Bulletins by Ir. W. Spoon † carries our knowledge of this subject a step further.

The first bulletin describes experiments made in sending the fruit of four varieties of *Mangifera indica* Linn from Java to Holland. The fruit ripens in Java towards the end of the dry season; in the western part of the island somewhat earlier than in the eastern part, during the months September to November. The voyage takes 5 to 6 weeks and arrivals in Europe would therefore supplement arrivals of shipments from South Africa which are made in January and February.

Not all varieties of mangoes keep equally well, especially after storage in Europe at normal temperatures; therefore quick sale is generally imperative. Great care should be taken not to bruise the fruit during picking and packing as bruised spots quickly deteriorate after the fruit has left the refrigerating room. The optimum temperature seems to be 3°C.

The fruit was packed in crates stuffed with coconut fibre; when packed in flat crates containing one layer only, it arrived in better condition. The fruits should be picked from the tree while still hard and green; some fruit ripens during the voyage, others quickly after arrival. Very unripe fruit that has been in cold storage for over 40 days appears to be no longer able to ripen.

The large-size "golek" variety appears to have the best keeping qualities; the "gedong"—(which shipped from Batavia, has the advantage of a week's difference in the length of voyage)—comes a close second; while the "Madu" and "arum-Manis" varieties are more delicate.

The percentage of saleable fruit unpacked differed greatly and probably depends greatly on the amount of care give to picking and packing and on the length of the voyage. The financial results were not unsatisfactory and with sufficient experience a regular remunerative trade might be built up. The wholesale price in the London market is three pence each for the South African mangoes and the first cost of the fruit should consequently not exceed one penny each off the tree.

The second pamphlet by this author described the results of the shipping of a few parcels of pomelo from Deli (Sumatra) and from Batavia (Java) to the Netherlands.

On one occasion the fruit was shipped in the hold resulting in 20 per cent. of the fruit being unfit for sale on arrival in Europe. On all other occasions, the

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*Malayan Agricultural Journal, Vol. XVIII, p. 106, "Experimental Consignments of Pineapples"; and p. 350 "The Transport of Fresh Fruit by Sea."

† Nos. 50 and 51 of the Division Commercial Museum of the Royal Society Colonial Institute of the Netherlands.

fruit was shipped in the refrigerating room at temperatures of 2°C to 4°C and there was practically no loss. The pomelo keeps very well in cold storage and ripens very well afterwards. Even at the 25 per cent. higher rate of freight for cold storage it pays better to ship in this way.

The variety of *Citrus maxima* Merr = syn. *C. decumana* Linn. best suited for the European market, is the more succulent variety "jeruk delima." The fruit of this variety is large, 6 to 8 inches in diameter, and heavy—weighing 2 to 3½ pounds. It is packed in round crates of split bamboo stuffed with coconut fibre, each containing 7 fruits. Smaller varieties are packed in wooden crates of the size and shape of kerosene tin cases, containing 18 to 21 fruits.

The first cost of the fruit is three to four pence each off the tree, according to size; the landed cost is respectively seven to nine pence.

The fruit has been examined for vitamin contents in the Laboratory of the Netherlands Institute for the Nutrition of the Nation at Amsterdam. A full report of the procedure and findings is given. The conclusion drawn is that the fruit contains the anti-scorbutic vitamin C in a sufficient quality to make it suitable as an anti-scorbutic remedy, though it does not contain as much of this vitamin as does lemon juice.

The Laboratory of the Public Health Service at Weltevreden also ranks the pomelo among the fruits, containing "considerable quantities" of the anti-xerophthalmic vitamin A and "large quantities" of the anti-scorbutic vitamin C.

The voyage in cold storage consequently does not seem to have affected detrimentally this property of the fruit.

L. A. J. R.

Reviews.

World Agricultural Tractor Trial 1930.

Official Report.

109 p.p and numerous illustrations. Oxford: Hall The Printer, Ltd.

Price one shilling.

This is the official report on tests and specifications of machines that were entered for trials in 1930 held under the auspices of the Royal Agricultural Society of England in conjunction with the Institute of Agricultural Engineering, University of Oxford.

The first section gives a full description of the methods by which the tests were conducted. A report of the general tests on tractors follows, together with a brief report of the Road Test. The tests of Market Garden cultivators are next dealt with. In the final section an illustration and specification of each machine is given, together with a brief extract from the results of its tests.

As the Foreword points out, "the object of these tests and of the Trials generally was not necessarily to determine which tractor is the best in its class, but simply to shew exactly what each machine was capable of doing under normal conditions."

In view of the growing importance of mechanised farming, this small volume is of value to those who wish to keep themselves informed on the improvements that are constantly being effected in this direction, or who contemplate its application to their own particular agricultural pursuits.

D. H. G.

The Application of Science to Crop-Production.

BY

A AND G. L. C. HOWARD,

81 pp., 12 pls., 7 figs. Humphrey Milford, Oxford University Press, B.I. Building, Nicol Road, Bombal. 1929, 10 shillings.

The Authors record their opinions on the application of botanical science to crop-production in India. An opportunity of giving practical expression to their views was afforded by the founding of the Institute of Plant Industry, Indore, of which the senior author is the Director.

Of the seven chapters of this book, the first two, viz: The Genesis of the Indore Experiment and The Institute of Plant Industry, Indore, with the

final two chapters on the maintenance of liaison between the Institute and its supporters and the organisation of research deal, not merely with the particular problems that faced the writers, but with the general question of policy regarding the organisation of agricultural research. The intermediate chapters are concerned with the investigations of the Institute in connection mainly with cotton.

The Chapter dealing with the Institute lays down a number of principles that should be observed by those whose duty it is to organise institutions for agricultural investigations. The system of research centres, financed, in part at least, by benefactors of various kinds is favoured in place of institutions financed and worked by Government, as the former system affords ample scope for rapid development and tends to make the bond between the research workers and the actual cultivator much closer and more intimate. The Institute is strongly supported financially by the Indian Central Cotton Committee. The parallel in Malaya is the Rubber Research Institute, financed by a cess on rubber. The point of view is that a research institute should be strongly supported financially by the industry that it endeavours to benefit.

Throughout the book the line of though has been: firstly, that the scientific and agricultural aspects of work on crop production should be as closely co-ordinated as possible. Secondly, that close liaison should be maintained between the Institute and its supporters; thirdly, that by means of demonstration farms and by organized visits of cultivators to the Institute the results achieved at the Institute may find wider application.

It is claimed that research and demonstration should be the only two branches recognised; that each should be considered of equal importance and of equal dignity; but that they should be distinct, not overlapping but working in concert.

The solution of the difficulties of organisation of agricultural research is thus found by giving up the artificial division of the subject, into long-range and local problems and substituting the more natural one, of research and demonstration.

The authors conclude that "the ideal system of conducting agricultural research in the Empire seems to lie in the simplification rather than in the elaboration of the organisation. All that is necessary appears to be to provide each region with a research institute of its own." From this point the efforts should be concentrated on obtaining the best men and providing them with the means necessary to carry out their ideas. "Any attempt to overstrain system of organisation in the hope that they may replace competent investigators can only end in failure. In research, the man is everything; the organisation is a minor matter."

Since this book was reviewed, the death has occurred of the second author, Mrs. G. L. C. Howard.

This death has brought to a premature end a notable career. Mrs. Howard's 25 years of research in India, mainly on plant-breeding and on the methods of applying science to crop production, provides a monument to her notable career. Her demise will be regretted not only by her immediate co-workers and friends,

but by scientists throughout the world, who have watched her brilliant career with interest and appreciated her valuable contributions to science.

D. H. G.

First Annual Report of the Executive Council of the Imperial Agricultural Bureaux.

This report reviews the activities of the Council for the year 1st. April, 1929, to 31st March, 1930.

After reference to the inception of the scheme, the report states the financial position, the details of which are given in an Appendix, and proceeds with an account of the progress made during the year under review.

A detailed account of the eight Bureaux was given in the *Malayan Agricultural Journal* of February 1930, so that reiteration is unnecessary. It will be remembered that the eight Bureaux are :—Animal Nutrition, Animal Genetics, Fruit Production, Soil Science, Plant Genetics (Herbage Plants), Agricultural Parasitology, Animal Health and Plant Genetics (for crops other than Herbage).

These eight Bureaux have been fully organised and it is expected that further increases in staff will be very few.

The officers of the Bureaux have been in consultation with the official correspondents resident in various portions of the Empire regarding the work and development of the Bureaux.

The year was necessarily one of organisation, although several of the Bureaux have already commenced the distribution of information on their particular branches of agricultural science.

The task of the Bureaux is not research work, but the collection and dissemination of information on research work accomplished or in progress, and the promotion of co-operative effort in the solution of common difficulties by putting research workers in touch with each other and through the enquiries that reach them, of indicating the problems demanding investigation.

The Council and the Directors of the Bureaux lay special stress on promoting direct contacts between officers of the Bureaux and research workers overseas.

The question of study leave has been considered. In this connection the present Directors of the Bureaux have given advice when consulted. The Bureaux are in touch with both Empire and Foreign Research Institutions and are prepared to advise regarding centres at which study leave might be spent and to endeavour to facilitate arrangements for such studies.

The report is an ungarnished record of the work that has been done and put in hand. It is not to be expected that any spectacular results could have been achieved in the short period that the Bureaux have functioned, but it would appear that developments are being made on lines which should prove of value to workers overseas to further the advance of scientific research in the Empire.

D. H. G.

Departmental.

FROM THE DISTRICTS.

The Weather.

The weather throughout the month was in general hot and dry with occasional heavy showers in some localities.

Remarks on Crops.

Rubber.—The local prices given for rubber from small holdings again declined, being $12 to $14.50 a picul for smoked sheet and $9 to $12 for unsmoked sheet.

Wintering commenced generally throughout the country during the month and in some districts was well advanced at its close.

In Pahang West a considerable number of Chinese owners of rubber discontinued tapping for a period of 7 to 10 days on either side of the Chinese New Year holiday. In the Negri Sembilan, on the other hand, tapping was resumed on many areas of small holdings on which it had been stopped for several months.

The dry weather had the usual effect of materially reducing the prevalence of Mouldy Rot disease in many of the infected localities. It was still prevalent, however, in the sub-District of Tanjong Malim and in parts of Selangor. Sanction was obtained to employ three additional temporary Malay Inspecting Officers in these more heavily infected Districts and the existing Inspectors gave special attention to the demonstration and enforcing of control measures.

Padi.—General information is given elsewhere in this number. In Pekan District about 1,070 acres of padi are reported to have been destroyed by the floods at the end of December and beginning of January last. A supply of 600 gantangs of the five months padi, Radin Siak, was sent to Pekan from Malacca for use as seed and a further supply was ordered.

Measurements of yields from trial plots of pedigree strains of padi were in progress in many parts of the country. Among results already recorded mention may be made of a yield of 800 gantangs (gallons) per acre from Radin 13 in Semantan Mukim of Temerloh District and 560 gantangs from Seraup Kechil No. 36 at Rantau Panjang in Pahang; while the latter strain at Perankap in Batang Padang District gave 450 gantangs per acre as compared with 250 to 300 gantangs obtained from local padi.

In Selangor and in parts of Pahang steps have been taken to alter the padi planting dates in the coming season, as it was found in the past season that planting was fixed too early, so that this operation was handicapped by dry weather and the harvest occurred during the normal rainy season instead of the drier months of February and March.

The padi fly (*Leptocorisa acuta*) M. Pianggang, occurred in large numbers on "dry" padi in the coastal Districts of Selangor. Stem borers and sucking insects did considerable damage to the later maturing padi in Kedah and were the subject of an investigation by the Assistant Entomologist, Mr. Miller.

Coconuts.—A severe outbreak of the nettle caterpillar, *Setora nitens,* occurred on an estate in Perak South at the beginning of the month. Vigorous efforts resulted in its control. At the end of the month only a very few young caterpillars could be found, most of the new generation having been killed by their insect parasites.

Coffee.—In Perak South crops were being harvested and prepared for the local market. In Temerloh District of Pahang the price of coffee was only $15 to $16 per picul.

Tea.—Arrangements have been made to conduct small scale trials of manures on Chinese small holdings planted with tea in Selangor.

Fruit.—Good crops of durians, guava and limes were harvested in Perak South. In the Negri Sembilan there were fairly large supplies of durians, mangosteens, langsat and rambutan, but towards the end of the month most of the crop had been harvested and local prices were rising. At the same time, supplies of rambai were beginning to reach the markets in fair quantities. In Pahang the fruit crops were variable. Langsat, pulasan, rambutan, mangosteen, rambai, duku and durian fruited heavily in Pekan District. In Raub and Bentong Districts fair crops of these fruits were produced, but in Temerloh District the crops of durian, rambutan and langsat were poor.

Vegetables.—During the month 5,168 piculs of vegetables were exported from Kinta District of Perak and were sent to all the principal railway stations between Alor Star in Kedah and Singapore. The Agricultural Field Officer, Negri Sembilan, reported a considerable fall in the price of vegetables, eggs and poultry in many areas and attributed it to the lower purchasing power of the community and not to larger supplies.

Notes on Demonstration Stations and Padi Test Plots.

Telok Chengkai Padi Experiment Station, Kedah.—Harvesting was in progress throughout the month. Ears of each pedigree strain were cut for seed and a large number of ears were selected in the local varieties grown to start line breeding during the coming season.

Kuala Kangsar Agricultural Station.—The old orange trees were removed, except for a few carrying marcots. The young trees were bearing a fair crop which is expected to ripen in April. Many of the vegetable beds were planted and the young plants made promising growth. Tobacco seed obtained from Kedah was sown.

Talang Padi Station.—The pedigree strains in the test plots were reaped, but the local padi for comparison, being of longer maturation period, was not quite ripe. The manurial plots were nearly ready for harvest.

Lenggong Padi Test Plot.—Reaping was in progress at the end of the month, but unfortunately, storms had caused lodging of both the pedigree strains and the local padi.

Tapah Agricultural Station.—The work of clearing the site was commenced and a lay-out plan was under consideration.

Dong Padi Test Station, Pahang.—Harvest was completed and the crop was expected to be even better than that of last year. Seed for the coming season's planting will be supplied to the Temerloh and Pekan Plots where the crops were almost entirely destroyed by floods.

Temerloh Padi Test Plot, Pahang.—Work was commenced on the new five acre site which is being laid out on the standard plan now adopted by the Department for these Test Plots.

Pekan Agricultural Station, Pahang.—Rambutan, pulasan and duku were planted; the vegetable plots were prepared for planting.

Pulau Gadong Padi Experiment Station, Malacca.—Harvesting was completed together with the attendant winnowing and measuring of yields. Work in connection with selection continued throughout the month. The stilling tank for the pumping installation was built.

Alor Gajah Padi Test Plot, Malacca.—Harvesting was completed and the crops from the different plots were winnowed, dried and measured.

Sungei Udang Agricultural Station, Malacca.—Good progress was made with the development of this new station.

Plants Distributed.

Small supplies of seed of three pedigree strains of padi were sent from Malacca for trial in Southern Siam. Seeds of various vegetables, including tomato, and of two species of green manure plants were distributed from the Pekan Station.

School Gardens.

All the schools were closed during the fasting month, and in some Districts for the subsequent padi harvest. A few were visited to advise on the reopening of the gardens after the holiday.

Rat Destruction.

In Krian only 2,046 rat tails were padi for. The figures for Province Wellesley were not available when this report was written. In Malacca rewards were paid for 25,930 tails, the great majority of the rats being caught by digging them out of holes in the dry bunds of the padi fields. The Malays in some parts of Malacca are now taking considerable interest in the destruction of rats. In Batang Padang District of Perak trapping and poisoning were continued and bush adjoining padi land was being cleared in order to remove shelter for rats. In Lower Perak District considerable damage was done to padi by rats and control measures received insufficient attention.

DEPARTMENTAL NOTES.

Tours of the Director.

The Director of Agriculture S.S. and F.M.S. toured the principal Western padi growing areas from January 31st. to February 6th. visiting Kedah, Penang, Province Wellesley, Krian, Taiping, Kuala Kangsar and Upper Perak. The work of the padi experimental stations and sites for certain new agricultural stations were inspected. Points of interest were discussed with administrative officers and with field officers of the Department.

On February 14th. the Director visited Fraser's Hill in connection with the work of the new farm and dairy. He conferred with the Senior Health Officers, Pahang and Selangor, and the Executive Engineer, Raub, concerning various details connected with the undertaking.

Cameron's Highlands was visited on February 20th. when the Director attended a meeting of the Cameron's Highlands Development Committee and inspected the Plantation.

Demonstration at Serdang.

A demonstration was held on February 13th. at the Government Experimental Plantation, Serdang, and was attended by a party of Chinese from Kuala Lumpur and Bentong, Pahang.

Although the tea factory was not working during the visit, the various processes were explained in detail. The general nursery and tea areas were inspected and the details of management explained and discussed.

The cultivation of oil palm and manufacture of oil was followed with much interest.

Much time was spent in the fruit nursery where special attention was devoted to vegetative propagation.

The visit to the stock farm aroused the usual interest, the Middle White pigs being especially admired.

Leave.

Mr. A. Sharples, Government Mycologist, returned from leave of absence on 15th. February, 1931.

From the date of his return from leave, Mr. Sharples has been seconded to the Rubber Research Institute of Malaya where he assumes the post of Head of the Pathological Division.

Mr. G. E. Mann, M.C., Vice-Principal, School of Agriculture, Malaya returned from leave of absence on 19th. February, 1931.

Statistical.

MARKET PRICES.

February, 1931.

Rubber.—The average price of rubber in Singapore was 11.9 cents per lb. against 12.8 cents per lb. in January, 1931. The highest price quoted was 12 cents per lb., the lowest 11 3/8 cents per lb. The average London price for the month was 3.8d. against 4.1d. per lb. for the previous month. The highest price was 3 7/8. per lb., the lowest 3 5/8d. per lb.

Palm Oil.—The price of palm oil in London is £16.10.0 to £16.15.0 F.O.B. according to position. It is stated that the price has been maintained on account of America buying in fairly large quantities. It is understood that they are using palm oil for the manufacture of margarine.

Copra.—The Singapore market for copra has been steady with moderate business passing. Prices at the end of the month shewed an upward tendency. Average prices were: Sundried, $5.67 per picul; Mixed, $5.33 per picul; Cake, $1.50 per picul. Corresponding prices in January were: $5.72. $5.41, $1.75 per picul.

Pineapples.—There is a moderate demand for ready, but buyers have withdrawn for distant delivery at lower prices. The tendency continues downwards. Average Singapore prices in February were 1½ lb. cubes, $3.53 per case; 1½ lb. sliced, flat, $3.27 per case; 1½ lb. tall, $3.63 per case.

Tapioca.—Singapore prices have been dull with a tendency towards lower prices. Average prices for the month were: Flake, fair, $4.07; Pearl, seed, $5.06 Pearl, medium, $6—all per picul. These prices shew a drop of 14 cents per picul in each case below the average prices ruling in January.

Sago.—Flour—Sarawak fair dropped to $2.40 per picul, but later recovered to $2.60 on the settlement of the Lancashire cotton dispute which created a better sentiment in the market. The price again dropped at the end of the month to $2.35 per picul. The average price for the month was $2.48 per picul. Pearl —small, fair, fell from $6.25 per picul to $6 per picul: Average price for the month $6.06 per picul.

Rice.—Average Singapore prices for February were: Siam No. 2, $175; Saigon No. 1, $161; Rangoon No. 1, $148—all per coyan—compared with $186; $176; $156 per coyan in January.

Gambier.—Market featureless, Singapore average prices in February were: block, $9.60; cube, No. 1, $15 per picul compared with average prices for January of $9.50 and $15 respectively.

Pepper.—In Singapore a moderate business continues to pass with a steady market. Demand is fair and the undertone is good. Average prices for the month were: Singapore, black, $21.06; Singapore, white, $36.88; Muntok, white,

$38.12 per picul compared with the January averages of $20.87; $36; $37.06 per picul respectively.

Cloves.—Average Singapore prices: Zanzibar, $62 per picul; Amboina $59 per picul compared with $62.25 and $60.25 per picul in January.

Nutmegs.—Average prices for February; 110 per lb. $25 per picul against $23.88 in January; 80 per lb. $29.75 per picul.

Mace.—Average Singapore prices: Siouw, $92.50 per picul; Amboina, $59.50 per picul.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports for February, and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd.

1 picul = 133 1/3 lbs. 1 coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

MARKETING MINOR CROPS.

The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Planters of some of the minor agricultural products frequently experience difficulty in getting in touch with buyers. It is thought that in such cases the assistance of the Department may be of particular value to producers.

Similar assistance also comes within the scope of the Malayan Information Agency, 57 Charing Cross, London, S.W.1. The Agency is in close touch with firms in the United Kingdom dealing with every kind of agricultural product from the tropics and in constant communication with the Imperial Institute, the Department of Overseas Trade and the Empire Marketing Board. The services of the Commercial Member of the Advisory Board of the Agency are also of great value in this connection.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JANUARY, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re exports)				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1930	during the month	during the year 1931	during the month		during the year 1931		during the month		during the year 1931		Dealers	Estates of 100 acres and over	Ports
								Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	..	12,260	15,396	12,268	12,268	10,029	10,029	Nil	4	Nil	4	14,014	7,697	14,014	7,697	12,877	15,369	...
Johore	...	2 207	4,639	3,741	3,741	4,229	4,229	Nil	Nil	Nil	Nil	629	7,129	629	7,129	2,257	4,801	...
Kedah	.	135	2,614	2,496	2,496	1,369	1,369	Nil	Nil	Nil	Nil	701	3,079	701	3,079	463	2,671	...
Perlis	.	11	10	8	8	16	16	Nil	Nil	Nil	Nil	Nil	25	Nil	25	10	10	...
Kelantan ...	. .	114	97	195	195	460	460	2	Nil	2	Nil	55	524	55	524	188	101	...
Trengganu* ...	.	55	50	52	52	26	26	Nil	Nil	Nil	Nil	Nil	78	Nil	78	55	50	. .
Total Malay States	.	15,082	22,806	18,760	18,760	16,129	16,129	2	4	2	4	15,399	18,532	15,399	18,532	15,850	23,002	...
STRAITS SETTLEMENTS																		
Malacca ...	...	3,241	1,905	1,212	1,212			Nil		Nil		5,179		5,179		3,365	1,664	...
Province Wellesley	...	130	660	510	510	(2)	(2)	Nil		Nil						133	663	...
Dindings ...	...	233	119	105	105	2,000	2,000	Nil	18,528	Nil	18,528	5,638	Nil	5,638	Nil	167	128	...
Penang	1,710	4,551	12	12	12			845		846						5,244	14	1,364
Singapore ...	3,859	31,455	335	193	193			8,143		8,143		15,363		15363		33,293	299	4,740
Total Straits Settlements	5 569	39,610	3.031	2,032	2,032	2,000	2,000	8,989	18,528	8 989	18,528	26,180	Nil	26,180	Nil	42,202	2,768	6,104
TOTAL MALAYA	5,569	54,692	25,837	20,792	20,792	18,129	18 129	8,991	18,532	8,991	18,532	41,579	18,532	41,579	18,532	58.052	25,770	6,104

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province Wesly D'dings Mcca.	Johore	Total
20	21	22	23	24	25	26
Smoked sheet	9,531	19,128	3,589	2,783	862	35,893
Crepe	655	10,621	943	665	229	13,113
Unsmoked sheet	1,555	3,544	712	217	696	8330
Scrap and lump	1,136				470	
Total all Grades	12,877	33,293	5,244	3,665	2,257	57,336

TABLE III

FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	25,752	25,752
Penang ...	10,115	10,115
Port Swettenham.	4,763	4,763
Malacca ...	949	949
MALAYA ...	41,579	41,579

TABLE IV

THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ...	33,075	33,075
Straits Settlements		
MALAYA ...	33,075	33,075

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month − Exports + Stocks at end of month *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] − [2] − [3] − [4] − [5] − [9] − [10] For the Straits Settlements, the figure is an estimate based on the average found for the year 1930. Purchases by dealers S.S. from estates of less than 100 acres during the month amounted to 2,630 tons.

3. Dealer' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25% scrap, lump, etc., 40% ; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with the omission of certain explanatory notes, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on February, 26, 1931.

GENERAL RICE SUMMARY

January, 1931.

Malaya.—69,000 tons of rice were imported and 18,000 tons exported during January 1931, compared with 73,000 and 19,000 tons respectively in January 1930. Of this total 56 per cent. of imports was from Siam, 39 per cent. from Burma, 4 per cent. from French Indo-China and 1 per cent. from other countries.

The average declared trade value of imports of rice into Malaya during January, 1931 was $4.94 per picul, compared with $5.27 in December, 1930. The average value per picul in 1930 was $6.52 compared with $7.23 in 1929.

The retail market prices in cents per gantang (Imperial gallon) in January were as follows:—Singapore 37, Penang 44, Malacca 38 compared with 44, 48 and 41 respectively in December, 1930. The average retail prices for 1930 were Singapore 50, Penang 52, Malacca 50.

Malayan padi reports for January shew that there are 97,992 acres of padi land in Perak, of which 80,855 acres, or 83 per cent. is at present under the crop. The padi in the main area —Krian—is not yet mature.

In Selangor, 23,236 acres of padi land exist, about 84 per cent. of which has been planted. Harvesting is proceeding on most of this area.

The area of padi land in Negri Sembilan is 36,672 acres of which 30,182 (82 per cent.) has been planted. Harvesting is in progress.

Reports from Pahang West, which has about 27,749 acres of padi land of which about three-quarters is planted, state that harvesting has either been completed or is in progress.

The Straits Settlements figures are as follows:—

Malacca: 32,615 acres of padi land of which 28,876 acres are planted.

Province Wellesley: 33,748 acres of padi land of which 32,342 acres are planted.

Dindings: 962 acres of padi land of which 782 are planted.

Penang: 4,000 acres of padi land of which 3,000 acres are planted.

Harvesting is proceeding in most parts of Province Wellesley and Penang.

Kedah has 210,040 acres of padi land. No returns are at present available of the area planted. Harvesting is in progress in most districts.

The Perlis harvesting is almost completed. Of the 38,480 acres of padi land in the State 35,750 acres (93 per cent.) has been planted this season.

India:—The total foreign exports of milled rice January to November, 1930 inclusive were 2,478,000 tons.

The fourth provincial forecast of the Burma rice crop for 1930-31 gives the area likely to mature at 12,509,600 acres, being 93,300 acres more than the final figures for the previous year. The estimated outturn amounts to 7,630,000 tons of rice.

The Burma export of rice and rice products from January 1 to December 27, 1930 was 3,421,574 tons as compared with 2,949,063 tons for the same period of 1929, or an increase of 16 per cent.

Average quotations at Rangoon for white rice of 100 baskets of 75 lbs. each between November 26 and December 17 were :—Big Mills Specials Rs. 230; Small Mills Specials Rs. 245 compared with 380 and 411 respectively for the same period of the previous year.

Japan :—A press report from Tokyo (January 22, 1931) states that the actual yield for 1930 has been estimated at 9,380,000 tons, an increase of 1,027,000 tons or 12.3 per cent. as compared with 1929, making a surplus of 1,543,000 tons of which 701,000 tons is being reserved by the government subsidy for next season; the balance (842,000 tons) being available for export. It is not clear whether these figures refer to milled rice or rice in the husk (padi), 100 units of padi being equivalent to 63 units of rice and rice products.

Siam :—According to the second official forecast *(Bangkok Times,* January 19, 1931) the area under padi in the seven main exporting circles at the end of November, 1930 was estimated at 4,592,000 acres, the area damaged at 480,000 acres or 10.5 per cent. and the yield 2,940,000 tons (rice), from which it is estimated that 1,750,000 tons will be available for export.

Java, Madura and Netherlands East Indies :—The position of the crop at the end of December, 1930 *(Korti Berichten,* January 1931) was as follows :—Wet padi total 9,616,000 acres, being 260,000 acres greater than in 1929. Of this, 7,557,000 acres have been harvested, 235,000 acres damaged and 1,824,000 is standing. Dry padi total 2,296,000 acres of which 1,188,000 acres have been harvested.

Imports into the Netherlands East Indies in 1930 amounted to 596,000 tons, being 101,000 less than in 1929.

French Indo-China :—In 1930, entries of padi into the port of Cholon amounted to 1,159,000 metric tons, while exports of rice from Saigon for this period were 1,058,000 tons.

H.B.M. Consul-General at Saigon reports for the month of December 1930 as follows :—The rice exported in 1930 was about 198,450 tons less than in 1929. It is calculated that some 200,000 tons of the old crop remains unexported. The crop in 1930 is good and it may be assumed that the exportable surplus will be 1,500,000 tons; this, together with what remains of the 1929 surplus makes some 1,700,000 tons available for export from Saigon during 1931. Tonkin has also some 500,000 tons available for export.

Ceylon :—Imports for 1930 amounted to 463,000 tons of which 319,000 were from Burma and 116,000 tons from British India. The imports were 6,000 tons greater in 1929.

Europe :—According to the London Rice Brokers' Association Weekly Circular dated December 18, 1930, 692,000 tons of rice were shipped from the East to Europe during the period January 1 to December 18, 1930, being a decrease of 52,000 tons over that of the previous year. Of these total ship-

ments 438,000 tons were from Burma, 212,000 tons from Saigon and 25,000 tons from Siam.

The Levant imported 20,000 tons and the West Indies and America 195,000 tons from the East from January 1 to November 14, 1930. The Levant shipments showed a decrease of 8,000 tons while the shipments to the West Indies and America increased by 16,000 tons over the previous year.

The above summary is abstracted from the General Rice summary for January prepared by the Registrar-General of Statistics, S.S. and F.M.S., and from statistical information concerning Malayan rice cultivation and production obtained by the Department of Agriculture, S.S. and F.M.S. The Department can only accept responsibility for the figures concerning local rice production.

One gantang (Imperial gallon) of rice weighs about 8 lbs. one picul=133.3 lbs.

The currency of Malaya is Straits Settlement currency $1=two shilling and four pence.

METEOROLOGICAL SUMMARY, MALAYA. JANUARY, 1931.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall									Bright Sunshine			
	Means of			Absolute Extremes						Total		Most in a day	Number of days						Total	Daily Mean	Per cent	Length of Day
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation* .01 in or more.	Precipitation, .04 in or more	Thunder-storm	Thunder heard	Fog morning obs.	Gale force 8 or more				
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.							hr.	hr.	%	hr.
Railway Hill, Kuala Lumpur, Selangor ...	89.3	72.6	80.9	95	70	76	74	82.9	83.4	8.15	207.0	2.88	22	19	...	8	3		155.30	5.01	42	12.0
Bukit Jeram, Selangor ...	87.5	73.1	80.3	91	70	77	75	83.7	85.3	10.54	267.7	2.38	21	18	2	19	6		188.90	6.09	51	12.0
Sitiawan, Perak ...	88.7	73.3	81.0	92	70	83	75	83.3	83.7	13.20	335.3	2.53	21	19	7	24	1		191.00	6.16	...	...
Kroh, Perak ...	86.1	68.9	77.5	92	62	79	72	78.0	80.5	3.53	89.67	0.77	10	11	...	2	1		194.15	6.26	...	...
Temerloh, Pahang ...	84.7	72.3	78.5	91	69	73	74	81.8	83.2	17.69	449.3	4.29	18	16	...	4	8		151.05	4.87	41	11.9
Kuala Lipis, Pahang ...	85.2	71.3	78.3	90	67	74	73	81.3	82.0	13.34	338.9	2.46	20	19	...	4	12		140.45	4.53	38	11.9
Kuala Pahang, Pahang ...	82.3	74.2	78.3	87	72	76	78	79.6	80.8	39.62	1006.3	6.69	20	20	1	1	...		156.70	5.05	42	11.9
Mount Faber, Singapore ...	87.2	73.3	80.3	92	71	76	75	79.7	81.1	11.56	293.6	1.68	23	20	1	9	3		159.25	5.14	43	12.1
Butterworth, Province Wellesley ...	88.6	73.4	81.0	93	70	86	76	83.6	83.4	4.88	124.0	2.47	12	10	2	13	...		233.90	7.55	...	...
Bukit China, Malacca ...	85.9	73.4	79.7	91	71	79	75	81.0	82.6	5.22	132.6	1.20	13	11	6	9	...		193.60	6.24	52	12.0
Kluang, Johore ...	86.0	72.5	79.3	91	70	77	74	80.6	81.3	8.60	218.4	3.80	16	16	...	1	12	1	157.35	5.08	42	12.0
Bukit Lalang, Mersing, Johore	82.0	73.1	77.5	85	69	77	77	79.7	80.1	14.43	366.1	2.32	19	16	...	1	...	2	168.55	5.44	45	12.0
Alor Star, Kedah ...	89.0	71.9	80.5	93	67	84	74	84.8	85.4	0.97	24.6	0.67	7	4	...	3	...		228.50	7.37	65	11.8
Kota Bharu, Kelantan ...	84.2	71.9	78.1	88	68	80	76	80.8	82.2	7.90	200.7	2.20	16	12	...	1	2		184.10	5.94	50	11.8
Kuala Trengganu, Trengganu	83.1	72.4	77.7	87	68	77	76	79.6	80.2	21.40	543.6	9.34	20	17	...	...	7		179.40	5.79	50	11.9
HILL STATIONS.																						
Cameron's Highlands, Rhodendron Hill, Pahang 5120 ft. ...	70.4	59.0	64.7	75	57	62	61	...	...	10.54	267.7	1.57	22	21	...	3	3		111.65	3.60	30	11.9
Cameron's Highlands, Tanah Rata, Pahang 4750 ft. ...	70.7	57.4	64.1	74	46	64	63	68.5	69.1	10.81	274.6	1.87	23	19	...	4	1		113.10	3.65	30	11.9
Fraser's Hill, Pahang 4268 ft.	68.9	61.2	65.0	73	59	63	63	69.8	70.0	12.90	327.7	2.40	23	21	...	4	28		100.05	3.23	27	11.9

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.